Appendix E

Air Quality Emissions Assumptions and Model

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Appendix E contains the following tables:

- Fugitive Emissions From Drilling Initial Wells (Year 1)
- Emissions from Drilling Rig Engines for Initial Wells (Year 1)
- Construction Emissions: Vehicle Engine Exhaust From Grading and Material Hauling Activities (Year 1)
- Construction Emissions: Fugitive Emissions From Construction Activities (Year 1)
- Projected Annual Emissions During Construction from POVs (Year 1)
- Fugitive Emissions From Drilling Secondary Wells (Year 2)
- Emissions from Drilling Rig Engines for Secondary Wells (Year 2)
- Construction Emissions: Vehicle Engine Exhaust From Grading and Material Hauling Activities (Year 2)
- Construction Emissions: Fugitive Emissions From Construction Activities (Year 2)
- Projected Annual Emissions During Construction from POVs (Year 2)
- Fugitive Emissions From Drilling Secondary Wells (Year 3)
- Emissions from Drilling Rig Engines for Secondary Wells (Year 3)
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- Emission Summaries
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Table 1: Fugitive Emissions From Drilling Initial Wells (Year 1)

Activity	No. of Wells	Emission Factor[1] PM-10 (lb/hole)	Total Emissions[2] PM-10 (Tons/Project)
Drilling Wells	3	1.3	**0.0020**

Notes:

1. Emission Factor from AP-42, Table 11.9-4 (5th Edition).
2. Total Emissions = No. of wells x Emission Factor/(2000 lb/Ton).

Table 2: Emissions from Drilling Rig Engines for Initial Wells (Year 1)

Average Power Rating (hp)	500	3	Number of Wells
Fuel Type	Diesel	24	Operating Hours per day/drill rig
Total Operating Hours (hr/yr)[1]	4,320	60	Drilling days per well
Load Factor	0.75		

	POLLUTANTS				
	PM-10	NOX	SO2	CO	VOC
Emission Factor (lb/hp-hr)[2,3]	0.00035	0.013	0.00205	0.01800	0.0022
Total Emissions (Tons/Project)[4]	**0.28**	**10.53**	**1.66**	**14.58**	**1.78**

Notes:

1. Total operating hours of all drill rigs.
2. Emission Factors from "Emission Standards Reference Guide for Heavy-Duty and Nonroad Engines," EPA420-F-97-014, Sept 1997, Nonroad CI Engines.
3. Emission Factor for SO2 from AP-42, Table 3.3-1 (5th Edition).
4. Total emissions = Average Power Rating x Total Operating Hours x Load Factor x Emission Factor/(2000 lb/ton).

Construction Emissions: Vehicle Engine Exhaust From Grading and Material Hauling Activities (Year 1)

Input Parameters/Assumptions:

Total Building Area:	0	ft^2
Total Paved Area:	0.00	ft^2
Total Disturbed Area:	19.40	acres
Construction Duration:	0.50	years
Annual Construction Activity:	250	days/yr
Total Demolition:	0	ft^2

Table 3 Summary of Input Parameters

	ROG[1]	NO_x	SO_2	CO	PM_{10}
Total new acres disturbed:	19.4	19.4	19.4	19.4	19.4
Total new building space, ft^2:	0.0	0.0	0.0	0.0	0.0
Total years:	0.50	0.50	0.50	0.50	0.50
Area graded, acres:	19.4	19.4	19.4	19.4	19.4

Emission Factors For Vehicle Engine Exhaust From Construction Activities

Activity	SMAQMD Emission Factor									
	ROG[1]		NO_x		SO_2 [2]		CO [2]		PM_{10}	
Grading Equipment[3]	2.91E-01	lbs/acre/day	2.75E+00	lbs/acre/day	0.18	lbs/acre/day	0.60	lbs/acre/day	2.32E-01	lbs/acre/day
Material Hauling[4]	4.20E-01	lbs/acre/day	6.07E+00	lbs/acre/day	0.40	lbs/acre/day	1.31	lbs/acre/day	4.30E-01	lbs/acre/day

Reference: *Air Quality Thresholds of Significance* , Sacramento Metropolitan Air Quality Management District (SMAQMD), 1994 and *Compilation of Air Pollutant Emission Factors* (USEPA AP-42).

1 ROG = VOC.

2 Factors for grading equipment are calculated from AP-42 for diesel engines using ratios with the NOx factors.

3 Grading Activities assumes the use of one tracked loader, one wheeled loader, and one motor grader for each 10 acres of disturbed area, used 8 hours per day.

4 Material Hauling Activities assumes the use of one loader and one haul truck for each 10 acres of disturbed area, used 8 hours per day.

Table 4 Total Daily Vehicle Engine Exhaust Emissions From Construction Actitivies[1]

	ROG	NO_x	SO_2	CO	PM_{10}
Grading Equipment	5.6	53.4	3.6	11.6	4.5
Material Hauling	8.1	117.8	7.8	25.5	8.3
Total Emissions (lbs/day):	**13.8**	**171.2**	**11.4**	**37.1**	**12.8**

1 Total Emissions (lbs/day) = Emission Factor * Affected Acres

Table 5 Total Vehicle Engine Exhaust Emissions from Construction Activities[1]

	ROG	NO_x	SO_2	CO	PM_{10}
Grading Equipment	0.35	3.34	0.22	0.72	0.28
Material Hauling	0.51	7.36	0.49	1.59	0.52
Fugitive Emissions (from page 2)					6.80
Total Emissions(tons/yr)	**0.86**	**10.70**	**0.71**	**2.32**	**7.60**

1 Total emissions (TPY) = Total emissions (lbs/day) * days of construction / 2000 lbs per ton

Construction Emissions: Fugitive Emissions From Construction Activities (Year 1)

Input Parameters / Assumptions			
Acres affected:	19.4	acres/yr	
Grading days/yr:	21	days/yr	
Exposed days/yr:	21	days/yr graded area is exposed	
Grading Hours/day:	8	hr/day	
Soil percent silt, s:	15	%	
Soil percent moisture, M:	2	%	
Fraction of TSP, J:	0.5	(SCAQMD recommendation)	
Mean vehicle speed, S:	5	mi/hr	(On-site)
Dozer path width:	5	ft	
Qty construction vehicles:	3	vehicles	
On-site VMT/vehicle/day:	5	mi/veh/day	(Excluding bulldozer VMT during grading)

Reference: *CEQA Air Quality Handbook* , SCAQMD, April 1993.

Equation Used To Calculate Operation Parameters

Operation Parameter	Emission Factor	Units	Equation
Grading duration per acre	8.7	hr/acre	Grading days * hours per day / acres affected
Bulldozer mileage per acre	1.7	VMT/acre	Miles traveled by bulldozer, based on dozer path width
Construction VMT per day	15	VMT/day	Number of vehicle * VMT per vehicle per day
Construction VMT per acre	16.2	VMT/acre	Construction VMT * days of construction / acres affected
			(Travel on unpaved surfaces within site)

Equations Used To Calculate Mass/Unit Emission Factors (Corrected for PM_{10})

Operation	Empirical Equation	Units	AP-42 Section (4th Edition)
Bulldozing	0.75(s^1.5)/(M^1.4)	lbs/hr	8.24, Overburden
Grading	(0.60)(0.051)S^2.0	lbs/VMT	8.24, Overburden
Vehicle Traffic	(3.72/(M^4.3))*.6	lbs/VMT	8.24, Overburden

Reference: *Compilation of Air Pollutant Emission Factors,* USEPA AP-42:
Section 8.24, Western Surface Coal Mining (4th Edition)

Emission Factors For Fugitive Emissions From Construction Activities[1]

Operation	Emission Factor (mass/ unit)		Operation Parameter		Emission Factor (lbs/acre)	
Bulldozing	16.51	lbs/hr	8.7	hr/acre	143.6	lbs/acre
Grading	0.77	lbs/VMT	1.7	VMT/acre	1.3	lbs/acre
Vehicle Traffic	0.11	lbs/VMT	16.20	VMT/acre	1.8	lbs/acre

1 Emission Factor (lbs/acre) = Emission Factor (lbs per hour or VMT) * Operation Parameter (hours of VMT per acre)

Table 6 Calculation of Annual Fugitive Emissions from Construction Activities

Source	Emission Factor		Graded Acres/yr	Exposed days/yr	Emissions lbs/yr	Emissions tons/yr
Bulldozing[1]	143.6	lbs/acre	19.40	NA	2,786	1.39
Grading[1]	1.3	lbs/acre	19.40	NA	25	0.01
Vehicle Traffic[1]	1.8	lbs/acre	19.40	NA	35	0.02
Erosion of Graded Surface[2]	26.4	lbs/acre/day[3]	19.40	21	10,755	5.38
TOTAL					**13,601**	**6.80**

1 Total annual emissions (TPY) = Emission Factor (lbs/acre) * affected acres * 2000 lbs per ton

2 Total annual emissions (TPY) from erosion = Emission Factor (lbs/acre) * days of construction * 2000 lbs per ton

3. Reference: CEQA Air Quality Handbook, SCAQMD, April 1993.

Projected Annual Emissions During Construction from POVs (Year 1)

POV Emission Factors

Fleet Year	Vehicle Type	EPA Category	Emission Factor (g/mile) NOx	CO	PM	VOC
1995	Cars	LDGV	1.22	13.2	0.022	1.12
	Pickups	LDGT1	1.63	18.49	0.022	1.63
	Heavy Trucks	HDDV	10.81	11.22	1.652	2.16
	Trucks (3 axles)	LDDT	1.21	1.52	0.26	0.6

Note:
Emission factors from Calculation Methods for Criteria Air Pollutant Emission Inventories (Armstrong Laboratory,1994).
Key:
LDGV = Light-duty gasoline-fueled vehicles designated for transport of up to 12 people.
LDGT1 = Light-duty gasoline-fueled trucks with a gross vehicle weight (GVW) rating of 6,000 pounds or less.
LDDT = Light-duty diesel-powered trucks with a GVW of 8,500 pounds or less.
HDDV = Heavy-duty diesel-powered vehicles with a GVW exceeding 8,500 pounds.

Table 7 Projected Criteria Air Pollutant Emissions From Privately Owner Vehicles

Group	Vehicle Type	Daily Vehicles (/day)	Daily Travel - Per Vehicle At Plant (VMT)	Off-Plant (VMT)	Total (VMT)	Travel Days (days/yr)	Annual Travel (VMT/yr)	Annual Emissions (lb/yr)[1] PM	NOx	VOC	CO
	Cars	7.0	4.0	0.0	4.0	180.0	5,040.0	0.2	13.6	12.4	146.7
	Pickups/Light Trucks	3.0	4.0	0.0	4.0	180.0	2,160.0	0.105	7.8	7.8	88.0
	Trucks	4.0	4.0	0.0	4.0	180.0	2,880.0	1.65	7.68	3.81	9.65
Vehicle Trips/Day	Heavy Trucks	1.0	4.0	0.0	4.0	180.0	720.0	2.6	17.2	3.4	17.8
15	**Total**	**15.0**	-	-	-	-	-	**4.62**	**46.2**	**27.4**	**262.2**
							TOTAL TPY[2]	**0.0023**	**0.023**	**0.014**	**0.13**

Notes:
1. Annual Emissions (lb/yr) = Emission Factor x Annual Travel/(453.6 g/lb)
2. Total TPY = Annual Emissions/(2000 lb/t).

Table 8: Fugitive Emissions From Drilling Secondary Wells (Year 2)

Activity	No. of Wells	Emission Factor[1] PM-10 (lb/hole)	Total Emissions[2] PM-10 (Tons/Project)
Drilling Wells	6	1.3	**0.0039**

Notes:

1. Emission Factor from AP-42, Table 11.9-4 (5th Edition).
2. Total Emissions = No. of wells x Emission Factor/(2000 lb/Ton).

Table 9: Emissions from Drilling Rig Engines for Secondary Wells (Year 2)

Average Power Rating (hp)	500	6	Number of Wells
Fuel Type	Diesel	24	Operating Hours per day/drill rig
Total Operating Hours (hr/yr)[1]	8,640	60	Drilling days per well
Load Factor	0.75		

	POLLUTANTS				
	PM-10	NOX	SO2	CO	VOC
Emission Factor (lb/hp-hr)[2,3]	0.00035	0.013	0.00205	0.01800	0.0022
Total Emissions (Tons/Project)[4]	**0.57**	**21.06**	**3.32**	**29.16**	**3.56**

Notes:

1. Total operating hours of all drill rigs.
2. Emission Factors from "Emission Standards Reference Guide for Heavy-Duty and Nonroad Engines," EPA420-F-97-014, Sept 1997, Nonroad CI Engines.
3. Emission Factor for SO2 from AP-42, Table 3.3-1 (5th Edition).
4. Total emissions = Average Power Rating x Total Operating Hours x Load Factor x Emission Factor/(2000 lb/ton).

Construction Emissions: Vehicle Engine Exhaust From Grading and Material Hauling Activities (Year 2)

Input Parameters/Assumptions:

Total Building Area:	0	ft^2
Total Paved Area:	0.00	ft^2
Total Disturbed Area:	64.30	acres
Construction Duration:	0.17	years
Annual Construction Activity:	250	days/yr
Total Demolition:	0	ft^2

Table 10 Summary of Input Parameters

	ROG[1]	NO_x	SO_2	CO	PM_{10}
Total new acres disturbed:	64.3	64.3	64.3	64.3	64.3
Total new building space, ft^2:	0.0	0.0	0.0	0.0	0.0
Total years:	0.17	0.17	0.17	0.17	0.17
Area graded, acres:	64.3	64.3	64.3	64.3	64.3

Emission Factors For Vehicle Engine Exhaust From Construction Activities

	SMAQMD Emission Factor									
Activity	ROG[1]		NO_x		SO_2 [2]		CO [2]		PM_{10}	
Grading Equipment[3]	2.91E-01	lbs/acre/day	2.75E+00	lbs/acre/day	0.18	lbs/acre/day	0.60	lbs/acre/day	2.32E-01	lbs/acre/day
Material Hauling[4]	4.20E-01	lbs/acre/day	6.07E+00	lbs/acre/day	0.40	lbs/acre/day	1.31	lbs/acre/day	4.30E-01	lbs/acre/day

Reference: *Air Quality Thresholds of Significance* , Sacramento Metropolitan Air Quality Management District (SMAQMD), 1994 and *Compilation of Air Pollutant Emission Factors* (USEPA AP-42).

1 ROG = VOC.

2 Factors for grading equipment are calculated from AP-42 for diesel engines using ratios with the NOx factors.

3 Grading Activities assumes the use of one tracked loader, one wheeled loader, and one motor grader for each 10 acres of disturbed area, used 8 hours per day.

4 Material Hauling Activities assumes the use of one loader and one haul truck for each 10 acres of disturbed area, used 8 hours per day.

Table 11 Total Daily Vehicle Engine Exhaust Emissions From Construction Actitivies[1]

	ROG	NO_x	SO_2	CO	PM_{10}
Grading Equipment	18.7	177.1	11.8	38.3	14.9
Material Hauling	27.0	390.3	26.0	84.5	27.6
Total Emissions (lbs/day):	**45.7**	**567.4**	**37.7**	**122.8**	**42.6**

1 Total Emissions (lbs/day) = Emission Factor * Affected Acres

Table 12 Total Vehicle Engine Exhaust Emissions from Construction Activities[1]

	ROG	NO_x	SO_2	CO	PM_{10}
Grading Equipment	0.40	3.76	0.25	0.81	0.32
Material Hauling	0.57	8.29	0.55	1.80	0.59
Fugitive Emissions (from page 2)					19.26
Total Emissions(tons/yr)	**0.97**	**12.06**	**0.80**	**2.61**	**20.17**

1 Total emissions (TPY) = Total emissions (lbs/day) * days of construction / 2000 lbs per ton

Construction Emissions: Fugitive Emissions From Construction Activities (Year 2)

Input Parameters / Assumptions			
Acres affected:	64.3	acres/yr	
Grading days/yr:	21	days/yr	
Exposed days/yr:	21	days/yr graded area is exposed	
Grading Hours/day:	8	hr/day	
Soil percent silt, s:	15	%	
Soil percent moisture, M:	2	%	
Fraction of TSP, J:	0.5	(SCAQMD recommendation)	
Mean vehicle speed, S:	5	mi/hr	(On-site)
Dozer path width:	5	ft	
Qty construction vehicles:	3	vehicles	
On-site VMT/vehicle/day:	5	mi/veh/day	(Excluding bulldozer VMT during grading)

Reference: *CEQA Air Quality Handbook* , SCAQMD, April 1993.

Equation Used To Calculate Operation Parameters

Operation Parameter	Emission Factor	Units	Equation
Grading duration per acre	2.6	hr/acre	Grading days * hours per day / acres affected
Bulldozer mileage per acre	1.7	VMT/acre	Miles traveled by bulldozer, based on dozer path width
Construction VMT per day	15	VMT/day	Number of vehicle * VMT per vehicle per day
Construction VMT per acre	4.9	VMT/acre	Construction VMT * days of construction / acres affected (Travel on unpaved surfaces within site)

Equations Used To Calculate Mass/Unit Emission Factors (Corrected for PM_{10})

Operation	Empirical Equation	Units	AP-42 Section (4th Edition)
Bulldozing	0.75(s^1.5)/(M^1.4)	lbs/hr	8.24, Overburden
Grading	(0.60)(0.051)S^2.0	lbs/VMT	8.24, Overburden
Vehicle Traffic	(3.72/(M^4.3))*.6	lbs/VMT	8.24, Overburden

Reference: *Compilation of Air Pollutant Emission Factors,* USEPA AP-42: Section 8.24, Western Surface Coal Mining (4th Edition)

Emission Factors For Fugitive Emissions From Construction Activities[1]

Operation	Emission Factor (mass/ unit)		Operation Parameter		Emission Factor (lbs/acre)	
Bulldozing	16.51	lbs/hr	2.6	hr/acre	42.9	lbs/acre
Grading	0.77	lbs/VMT	1.7	VMT/acre	1.3	lbs/acre
Vehicle Traffic	0.11	lbs/VMT	4.90	VMT/acre	0.5	lbs/acre

1 Emission Factor (lbs/acre) = Emission Factor (lbs per hour or VMT) * Operation Parameter (hours of VMT per acre)

Table 13 Calculation of Annual Fugitive Emissions from Construction Activities

Source	Emission Factor		Graded Acres/yr	Exposed days/yr	Emissions lbs/yr	Emissions tons/yr
Bulldozing[1]	42.9	lbs/acre	64.30	NA	2,758	1.38
Grading[1]	1.3	lbs/acre	64.30	NA	84	0.04
Vehicle Traffic[1]	0.5	lbs/acre	64.30	NA	32	0.02
Erosion of Graded Surface[2]	26.4	lbs/acre/day[3]	64.30	21	35,648	17.82
TOTAL					**38,522**	**19.26**

1 Total annual emissions (TPY) = Emission Factor (lbs/acre) * affected acres * 2000 lbs per ton

2 Total annual emissions (TPY) from erosion = Emission Factor (lbs/acre) * days of construction * 2000 lbs per ton

3. Reference: CEQA Air Quality Handbook, SCAQMD, April 1993.

Projected Annual Emissions During Construction from POVs (Year 2)

POV Emission Factors

Fleet Year	Vehicle Type	EPA Category	Emission Factor (g/mile) NOx	CO	PM	VOC
1995	Cars	LDGV	1.22	13.2	0.022	1.12
	Pickups	LDGT1	1.63	18.49	0.022	1.63
	Heavy Trucks	HDDV	10.81	11.22	1.652	2.16
	Trucks (3 axles)	LDDT	1.21	1.52	0.26	0.6

Note:
Emission factors from Calculation Methods for Criteria Air Pollutant Emission Inventories (Armstrong Laboratory,1994).
Key:
LDGV = Light-duty gasoline-fueled vehicles designated for transport of up to 12 people.
LDGT1 = Light-duty gasoline-fueled trucks with a gross vehicle weight (GVW) rating of 6,000 pounds or less.
LDDT = Light-duty diesel-powered trucks with a GVW of 8,500 pounds or less.
HDDV = Heavy-duty diesel-powered vehicles with a GVW exceeding 8,500 pounds.

Table 14 Projected Criteria Air Pollutant Emissions From Privately Owner Vehicles

Group	Vehicle Type	Daily Vehicles (/day)	Daily Travel - Per Vehicle At Plant (VMT)	Off-Plant (VMT)	Total (VMT)	Travel Days (days/yr)	Annual Travel (VMT/yr)	Annual Emissions (lb/yr)[1] PM	NOx	VOC	CO
	Cars	100.0	4.0	0.0	4.0	180.0	72,000.0	3.5	193.7	177.8	2,095.2
	Pickups/Light Trucks	100.0	4.0	0.0	4.0	180.0	72,000.0	3.5	258.7	258.7	2,934.9
	Trucks	16.0	4.0	0.0	4.0	180.0	11,520.0	6.6	30.7	15.2	38.6
Vehicle Trips/Day	Heavy Trucks	3.0	4.0	0.0	4.0	180.0	2,160.0	7.9	51.5	10.3	53.4
219	**Total**	**219.0**	-	-	-	-	-	**21.5**	**534.6**	**462.0**	**5,122.2**
							TOTAL TPY[2]	**0.011**	**0.27**	**0.23**	**2.56**

Notes:
1. Annual Emissions (lb/yr) = Emission Factor x Annual Travel/(453.6 g/lb)
2. Total TPY = Annual Emissions/(2000 lb/t).

Table 15: Fugitive Emissions From Drilling Secondary Wells (Year 3)

Activity	No. of Wells	Emission Factor[1] PM-10 (lb/hole)	Total Emissions[2] PM-10 (Tons/Project)
Drilling Wells	2	1.3	**0.0013**

Notes:

1. Emission Factor from AP-42, Table 11.9-4 (5th Edition).
2. Total Emissions = No. of wells x Emission Factor/(2000 lb/Ton).

Table 16: Emissions from Drilling Rig Engines for Secondary Wells (Year 3)

Average Power Rating (hp)	500	2	Number of Wells
Fuel Type	Diesel	24	Operating Hours per day/drill rig
Total Operating Hours (hr/yr)[1]	2,880	60	Drilling days per well
Load Factor	0.75		

	POLLUTANTS				
	PM-10	NOX	SO2	CO	VOC
Emission Factor (lb/hp-hr)[2,3]	0.00035	0.013	0.00205	0.01800	0.0022
Total Emissions (Tons/Project)[4]	**0.19**	**7.02**	**1.11**	**9.72**	**1.19**

Notes:

1. Total operating hours of all drill rigs.
2. Emission Factors from "Emission Standards Reference Guide for Heavy-Duty and Nonroad Engines," EPA420-F-97-014, Sept 1997, Nonroad CI Engines.
3. Emission Factor for SO2 from AP-42, Table 3.3-1 (5th Edition).
4. Total emissions = Average Power Rating x Total Operating Hours x Load Factor x Emission Factor/(2000 lb/ton).

Construction Emissions: Vehicle Engine Exhaust From Grading and Material Hauling Activities (Year 3)

Input Parameters/Assumptions:

Total Building Area:	326,700	ft^2
Total Paved Area:	0.00	ft^2
Total Disturbed Area:	13.60	acres
Construction Duration:	0.17	years
Annual Construction Activity:	250	days/yr
Total Demolition:	0	ft^2

Table 17 Summary of Input Parameters

	ROG[1]	NO_x	SO_2	CO	PM_{10}
Total new acres disturbed:	13.6	13.6	13.6	13.6	13.6
Total new building space, ft^2:	326700.0	326700.0	326700.0	326700.0	326700.0
Total years:	0.17	0.17	0.17	0.17	0.17
Area graded, acres:	13.6	13.6	13.6	13.6	13.6

Emission Factors For Vehicle Engine Exhaust From Construction Activities

Activity	SMAQMD Emission Factor									
	ROG[1]		NO_x		SO_2 [2]		CO [2]		PM_{10}	
Grading Equipment[3]	2.91E-01	lbs/acre/day	2.75E+00	lbs/acre/day	0.18	lbs/acre/day	0.60	lbs/acre/day	2.32E-01	lbs/acre/day
Material Hauling[4]	4.20E-01	lbs/acre/day	6.07E+00	lbs/acre/day	0.40	lbs/acre/day	1.31	lbs/acre/day	4.30E-01	lbs/acre/day

Reference: *Air Quality Thresholds of Significance* , Sacramento Metropolitan Air Quality Management District (SMAQMD), 1994 and *Compilation of Air Pollutant Emission Factors* (USEPA AP-42).

1 ROG = VOC.

2 Factors for grading equipment are calculated from AP-42 for diesel engines using ratios with the NOx factors.

3 Grading Activities assumes the use of one tracked loader, one wheeled loader, and one motor grader for each 10 acres of disturbed area, used 8 hours per day.

4 Material Hauling Activities assumes the use of one loader and one haul truck for each 10 acres of disturbed area, used 8 hours per day.

Table 18 Total Daily Vehicle Engine Exhaust Emissions From Construction Actitivies[1]

	ROG	NO_x	SO_2	CO	PM_{10}
Grading Equipment	4.0	37.5	2.5	8.1	3.2
Material Hauling	5.7	82.6	5.5	17.9	5.8
Total Emissions (lbs/day):	**9.7**	**120.0**	**8.0**	**26.0**	**9.0**

1 Total Emissions (lbs/day) = Emission Factor * Affected Acres

Table 19 Total Vehicle Engine Exhaust Emissions from Construction Activities[1]

	ROG	NO_x	SO_2	CO	PM_{10}
Grading Equipment	0.08	0.80	0.05	0.17	0.07
Material Hauling	0.12	1.75	0.12	0.38	0.12
Fugitive Emissions (from page 2)					5.19
Total Emissions(tons/yr)	**0.21**	**2.55**	**0.17**	**0.55**	**5.38**

1 Total emissions (TPY) = Total emissions (lbs/day) * days of construction / 2000 lbs per ton

Construction Emissions: Fugitive Emissions From Construction Activities (Year 3)

Input Parameters / Assumptions			
Acres affected:	13.6	acres/yr	
Grading days/yr:	21	days/yr	
Exposed days/yr:	21	days/yr graded area is exposed	
Grading Hours/day:	8	hr/day	
Soil percent silt, s:	15	%	
Soil percent moisture, M:	2	%	
Fraction of TSP, J:	0.5	(SCAQMD recommendation)	
Mean vehicle speed, S:	5	mi/hr	(On-site)
Dozer path width:	5	ft	
Qty construction vehicles:	3	vehicles	
On-site VMT/vehicle/day:	5	mi/veh/day	(Excluding bulldozer VMT during grading)

Reference: *CEQA Air Quality Handbook* , SCAQMD, April 1993.

Equation Used To Calculate Operation Parameters

Operation Parameter	Emission Factor	Units	Equation
Grading duration per acre	12.4	hr/acre	Grading days * hours per day / acres affected
Bulldozer mileage per acre	1.7	VMT/acre	Miles traveled by bulldozer, based on dozer path width
Construction VMT per day	15	VMT/day	Number of vehicle * VMT per vehicle per day
Construction VMT per acre	23.2	VMT/acre	Construction VMT * days of construction / acres affected
			(Travel on unpaved surfaces within site)

Equations Used To Calculate Mass/Unit Emission Factors (Corrected for PM_{10})

Operation	Empirical Equation	Units	AP-42 Section (4th Edition)
Bulldozing	0.75(s^1.5)/(M^1.4)	lbs/hr	8.24, Overburden
Grading	(0.60)(0.051)S^2.0	lbs/VMT	8.24, Overburden
Vehicle Traffic	(3.72/(M^4.3))*.6	lbs/VMT	8.24, Overburden

Reference: *Compilation of Air Pollutant Emission Factors,* USEPA AP-42:
Section 8.24, Western Surface Coal Mining (4th Edition)

Emission Factors For Fugitive Emissions From Construction Activities[1]

Operation	Emission Factor (mass/ unit)		Operation Parameter		Emission Factor (lbs/acre)	
Bulldozing	16.51	lbs/hr	12.4	hr/acre	204.7	lbs/acre
Grading	0.77	lbs/VMT	1.7	VMT/acre	1.3	lbs/acre
Vehicle Traffic	0.11	lbs/VMT	23.20	VMT/acre	2.6	lbs/acre

1 Emission Factor (lbs/acre) = Emission Factor (lbs per hour or VMT) * Operation Parameter (hours of VMT per acre)

Table 20 Calculation of Annual Fugitive Emissions from Construction Activities

Source	Emission Factor		Graded Acres/yr	Exposed days/yr	Emissions lbs/yr	Emissions tons/yr
Bulldozing[1]	204.7	lbs/acre	13.60	NA	2,784	1.39
Grading[1]	1.3	lbs/acre	13.60	NA	18	0.01
Vehicle Traffic[1]	2.6	lbs/acre	13.60	NA	35	0.02
Erosion of Graded Surface[2]	26.4	lbs/acre/day[3]	13.60	21	7,540	3.77
TOTAL					**10,377**	**5.19**

1 Total annual emissions (TPY) = Emission Factor (lbs/acre) * affected acres * 2000 lbs per ton

2 Total annual emissions (TPY) from erosion = Emission Factor (lbs/acre) * days of construction * 2000 lbs per ton

3. Reference: CEQA Air Quality Handbook, SCAQMD, April 1993.

Projected Annual Emissions During Construction from POVs (Year 3)

POV Emission Factors

Fleet Year	Vehicle Type	EPA Category	Emission Factor (g/mile) NOx	CO	PM	VOC
1995	Cars	LDGV	1.22	13.2	0.022	1.12
	Pickups	LDGT1	1.63	18.49	0.022	1.63
	Heavy Trucks	HDDV	10.81	11.22	1.652	2.16
	Trucks (3 axles)	LDDT	1.21	1.52	0.26	0.6

Note:
Emission factors from Calculation Methods for Criteria Air Pollutant Emission Inventories (Armstrong Laboratory,1994).
Key:
LDGV = Light-duty gasoline-fueled vehicles designated for transport of up to 12 people.
LDGT1 = Light-duty gasoline-fueled trucks with a gross vehicle weight (GVW) rating of 6,000 pounds or less.
LDDT = Light-duty diesel-powered trucks with a GVW of 8,500 pounds or less.
HDDV = Heavy-duty diesel-powered vehicles with a GVW exceeding 8,500 pounds.

Table 15 Projected Criteria Air Pollutant Emissions From Privately Owner Vehicles

Group	Vehicle Type	Daily Vehicles (/day)	Daily Travel - Per Vehicle At Plant (VMT)	Off-Plant (VMT)	Total (VMT)	Travel Days (days/yr)	Annual Travel (VMT/yr)	Annual Emissions (lb/yr)[1] PM	NOx	VOC	CO
	Cars	100.0	4.0	0.0	4.0	60.0	24,000.0	1.2	64.6	59.3	698.4
	Pickups/Light Trucks	100.0	4.0	0.0	4.0	60.0	24,000.0	1.2	86.2	86.2	978.3
	Trucks	8.0	4.0	0.0	4.0	60.0	1,920.0	1.1	5.1	2.5	6.4
Vehicle Trips/Day	Heavy Trucks	2.0	4.0	0.0	4.0	60.0	480.0	1.7	11.4	2.3	11.9
210	**Total**	**210.0**	-	-	-	-	-	**5.2**	**167.4**	**150.3**	**1,695.0**
							TOTAL TPY[2]	**0.0026**	**0.084**	**0.075**	**0.85**

Notes:
1. Annual Emissions (lb/yr) = Emission Factor x Annual Travel/(453.6 g/lb)
2. Total TPY = Annual Emissions/(2000 lb/t).

EMISSION SUMMARIES

Year 1

Type	Annual Emissions (T/Yr) PM-10	NOX	VOC	SO2	CO
Well Drilling - Fugitive	0.0020	---	---	---	---
Well Drilling - Combustion	0.28	10.53	1.78	1.66	14.58
Construction	7.60	10.70	0.86	0.71	2.32
POV	0.0023	0.023	0.014	---	0.13
Totals	**7.89**	**21.25**	**2.66**	**2.37**	**17.03**

Year 2

Type	Annual Emissions (T/Yr) PM-10	NOX	VOC	SO2	CO
Well Drilling - Fugitive	0.0039	---	---	---	---
Well Drilling - Combustion	0.57	21.06	3.56	3.32	29.16
Construction	20.17	12.06	0.97	0.80	2.61
POV	0.011	0.27	0.23	---	2.56
Totals	**20.75**	**33.38**	**4.77**	**4.12**	**34.33**

Year 3

Type	Annual Emissions (T/Yr) PM-10	NOX	VOC	SO2	CO
Well Drilling - Fugitive	0.0013	---	---	---	---
Well Drilling - Combustion	0.19	7.02	1.19	1.11	9.72
Construction	5.38	2.55	0.21	0.17	0.55
POV	0.0026	0.084	0.075	---	0.85
Totals	**5.57**	**9.65**	**1.47**	**1.28**	**11.12**

Projected Annual Emissions from POVs During Operations

POV Emission Factors

Fleet Year	Vehicle Type	EPA Category	Emission Factor (g/mile) NOx	CO	PM	VOC
1995	Cars	LDGV	1.22	13.2	0.022	1.12
	Pickups	LDGT1	1.63	18.49	0.022	1.63
	Heavy Trucks	HDDV	10.81	11.22	1.652	2.16
	Trucks (3 axles)	LDDT	1.21	1.52	0.26	0.6

Note:
Emission factors from Calculation Methods for Criteria Air Pollutant Emission Inventories (Armstrong Laboratory,1994).
Key:
LDGV = Light-duty gasoline-fueled vehicles designated for transport of up to 12 people.
LDGT1 = Light-duty gasoline-fueled trucks with a gross vehicle weight (GVW) rating of 6,000 pounds or less.
LDDT = Light-duty diesel-powered trucks with a GVW of 8,500 pounds or less.
HDDV = Heavy-duty diesel-powered vehicles with a GVW exceeding 8,500 pounds.

Table 15 Projected Criteria Air Pollutant Emissions From Privately Owner Vehicles

Group	Vehicle Type	Daily Vehicles (/day)	Daily Travel - Per Vehicle At Plant (VMT)	Off-Plant (VMT)	Total (VMT)	Travel Days (days/yr)	Annual Travel (VMT/yr)	Annual Emissions (lb/yr)[1] PM	NOx	VOC	CO
	Cars	59.5	4.0	10.0	14.0	60.0	49,980.0	2.4	134.4	123.4	1,454.4
	Pickups/Light Trucks	25.5	4.0	10.0	14.0	60.0	21,420.0	1.0	77.0	77.0	873.1
	Trucks	0.0	4.0	10.0	14.0	60.0	0.0	0.0	0.0	0.0	0.0
Vehicle Trips/Day	Heavy Trucks	0.0	4.0	10.0	14.0	60.0	0.0	0.0	0.0	0.0	0.0
85	**Total**	**85.0**	-	-	-	-	-	**3.5**	**211.4**	**200.4**	**2,327.6**
							TOTAL TPY[2]	**0.0017**	**0.11**	**0.10**	**1.16**

Notes:
1. Annual Emissions (lb/yr) = Emission Factor x Annual Travel/(453.6 g/lb)
2. Total TPY = Annual Emissions/(2000 lb/t).